

Research Highlights

- Windbreaks are common features in flat agricultural landscapes around the world.
- The reduction in wind speed afforded by windbreaks is dictated by their porosity, location, height, and distance from the windbreak.
- The reduction in wind speeds not only reduces potential wind erosion; it also reduces crop evapotranspiration (ET) and irrigation spray losses.
- The impact of reducing windbreaks needs to be understood in terms of water resources use.

Methods

- Experimental and theoretical work was conducted to quantify the reduction in wind speeds by windbreaks in relation to:
 - Crop ET changes
 - Irrigation spray losses
- A temporal and spatial windbreak model was also developed and validated to quantify the impact of single and multiple windbreaks on irrigation water losses.

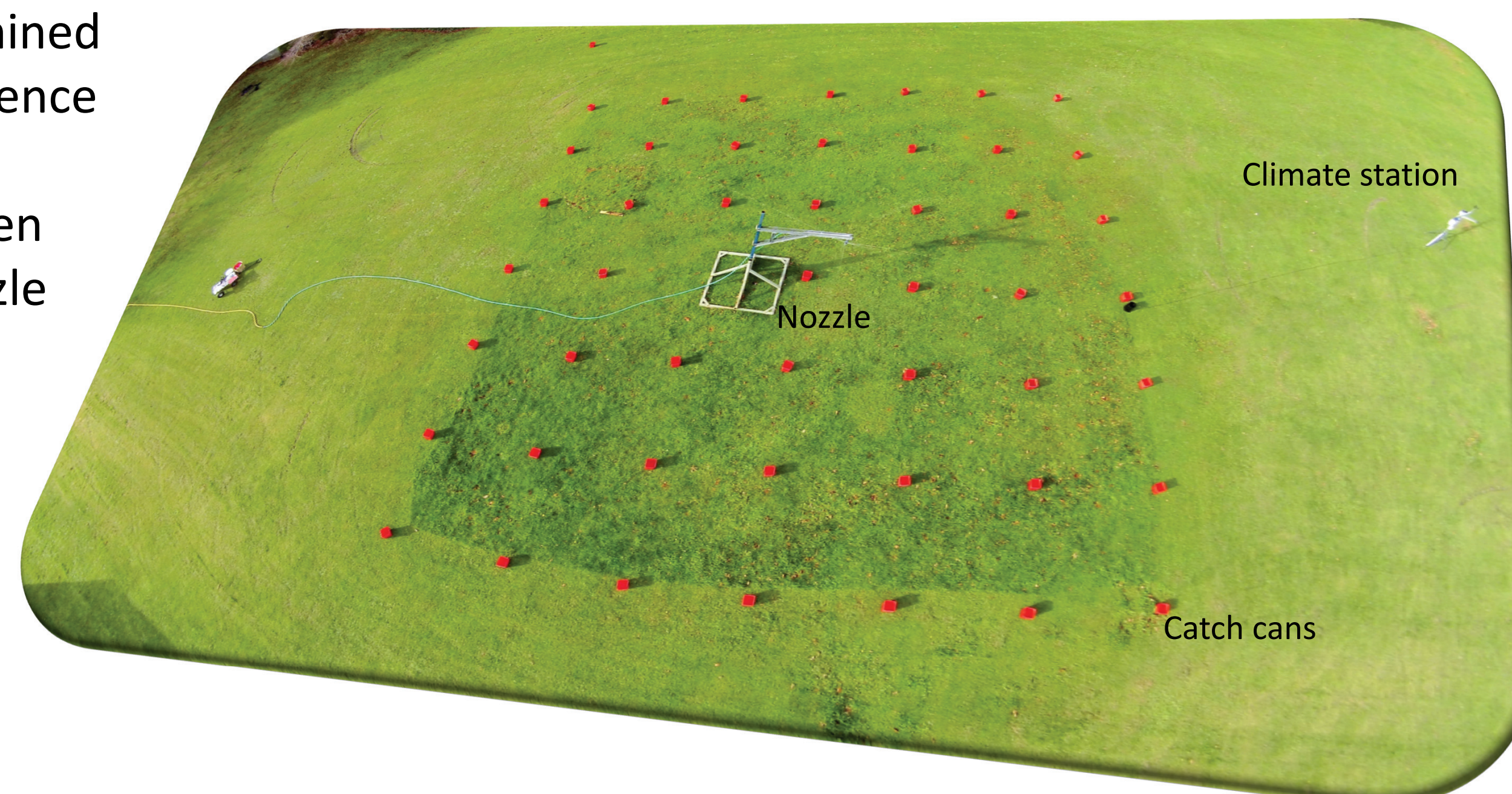
Monitoring wind velocity behind windbreaks

- Multiple wind sensors behind and in front of windbreaks.



Measuring spray losses due to wind and other climatic parameters.

- Spray losses determined by measuring difference in water electric conductivity between irrigation spray nozzle and catch cans.

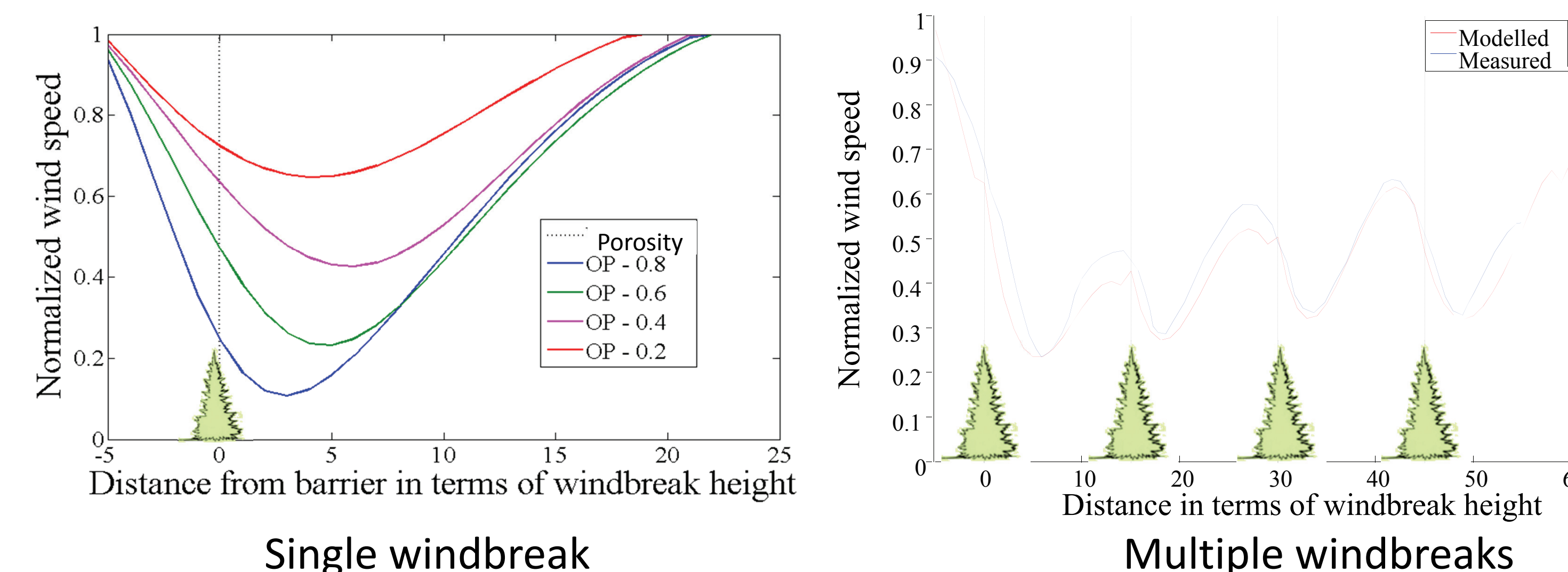


Windbreaks in Canterbury, New Zealand

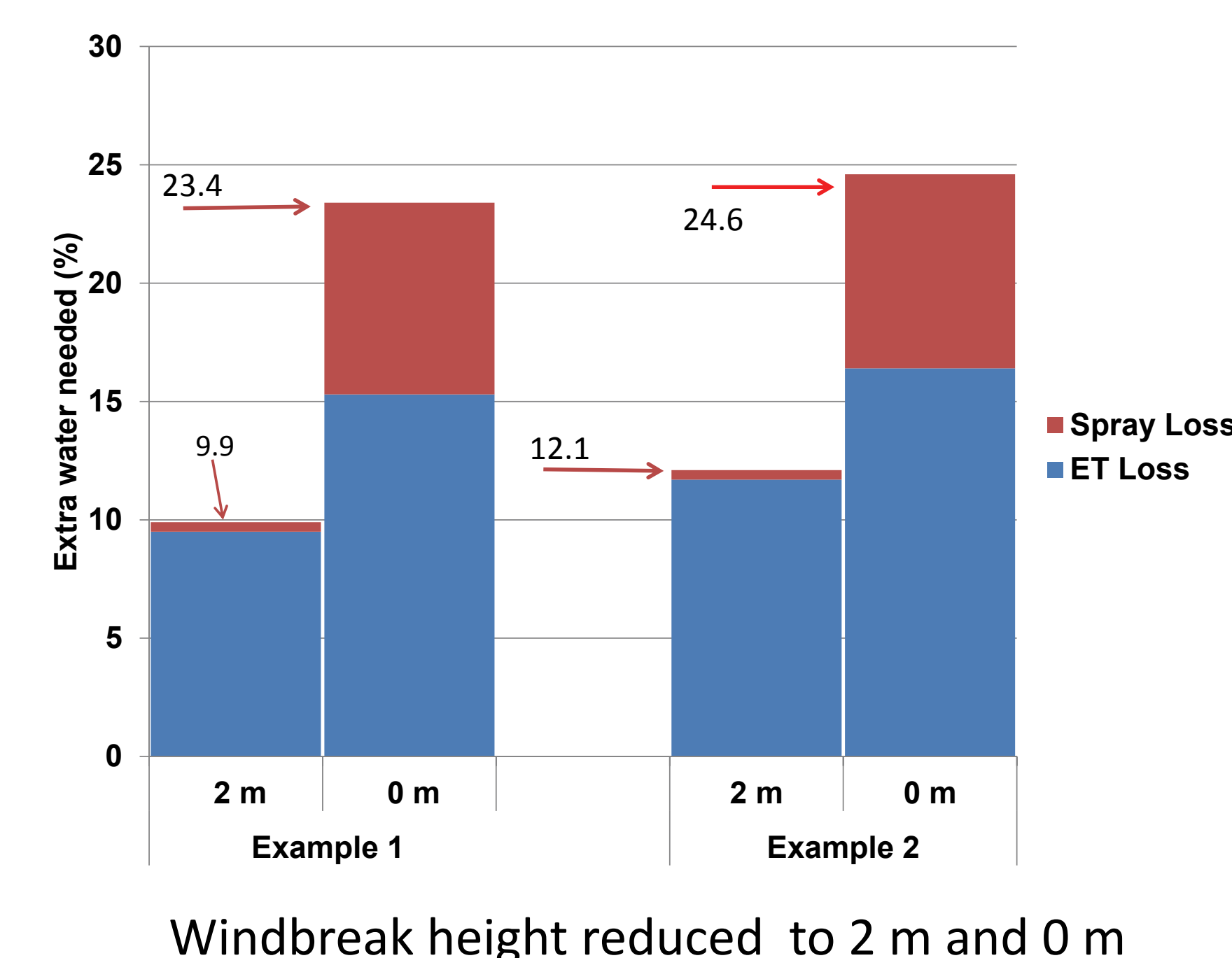
- There are over 300,000 km of windbreaks in Canterbury.
- Originally implemented to reduce wind erosion of prime agricultural land.
- Agriculture has since changed to irrigated pasture cultivation for dairy production and windbreaks are being cut down or reduced in height to allow for centre-pivot irrigation.
- Irrigation water is sourced from limited supplies of ground and surface water and thus the effects of wind on irrigation losses due to spray drift and increased ET are of significant concern.



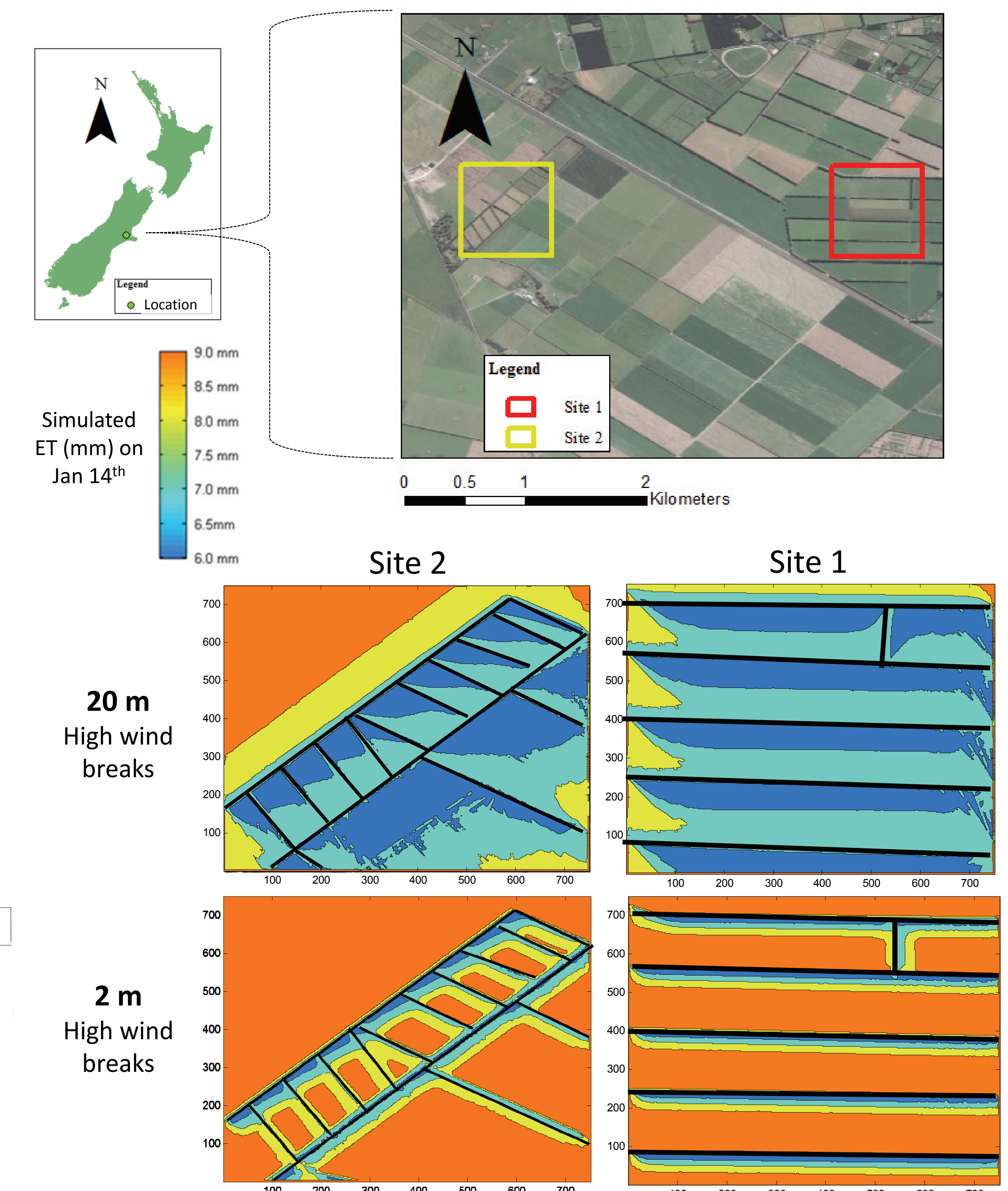
Changes in wind velocity



Extra yearly water needs due to windbreak height reduction



Model simulation examples: Impact of windbreak height on ET



Conclusions and Recommendations

Windbreak Model

- Model can be applied on an hourly, daily or yearly basis.

- GIS model useful for temporal and spatial scenario simulations (with, without, and reduced windbreak heights).

- Good match between observed and predicted.

Impacts on water resources

- Significant increases in water use (up to 30% in some cases) when windbreaks are reduced or eliminated.

- Development of cost effective irrigation systems needed that can be used within windbreaks.

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